Spiny theridiids in the Asian tropics. Systematics, notes on behaviour and species richness (Araneae: Theridiidae: Chrysso, Meotipa)

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Spiny theridiids in the Asian tropics. Systematics, notes on behaviour and species richness (Araneae: Theridiidae: *Chrysso, Meotipa*)

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ABSTRACT Contrib. Nat. Hist. 12: 403–436.

The genus *Meotipa* SIMON is removed from synonymy of *Chrysso*. It is redefined, the type species *picturata* SIMON (♀) and *M. vesiculosa* SIMON (♂♀) are redescribed. *M. thalerorum* sp. nov. (♂♀), *M. bituberculata* sp. nov. (♂♀), *M. impatiens* sp. nov. (♂♀), and *M. pallida* sp. nov. (♀) are described. The distribution ranges from India to the Philippines and Japan. All here described species have dwarf males. In some species, most females have one or more stuck emboli in the vulva. The closely related species *Chrysso spiniventris* O. P.-CAMBRIDGE is discussed; it shares several synapomorphies with *Meotipa*, among which some behavioural. The latter species is widely distributed through Southeast Asia and is one of a swarm of stenotopic, mostly undescribed species, most often occupying small ranges through all of South Asia and Queensland. The position of these species in the genus *Chrysso* may not be correct either.

It is argued that in the huge formerly continuous belts of tropical rainforest, many widespread spider species occur side by side with huge swarms of stenotopic species with small ranges, and apparently lacking dispersal skills. The latter phenomenon has a huge impact on the actual species numbers, aggravating the chance of extinction as a consequence of large–scale and haphazard deforestation.

"*Chrysso*" *nigra* O. P.-CAMBRIDGE is unrelated to *Chrysso* and *Meotipa*.

Keywords: biodiversity, tropical forests, tree canopy, Malaysian region, taxonomy, cobweb spiders, cryptic posture, male dwarfism, male genital organ mutilation, zoogeography, endemism.

Introduction

Long-legged theridiid spiders bearing conspicuous flattened black spines on the abdomen and/or legs are quite common in the foliage of the tropical rainforest, from Sri Lanka east- and southwards to Japan and N. Queensland. These spiders have a high, in lateral view more or less triangular abdomen with elevated rounded tip and are dorsally snowy white with a black and sometimes reddish pattern, often with a series of thin lines on the flanks. They are often found on the undersurface of old leaves clothed with lichen and fungi and on this background the black, white and red patterns and the brushes of black scale-like spines on legs and abdomen blur their outline and enhance their disguise.

Furthermore, they are unusual in three respects:

1) the normal resting position of adult females is remarkable: with the side of the carapace and abdomen turned towards the leaf surface (Figs. 1, 21), all four legs are directed around the dorsal side of the body, parallel with the surface of the leaf.
2) Females of some of the larger species have one or more emboli stuck in their epigyne.
3) Males in these species are much smaller than females and, not surprisingly, relatively rare. All examined males have both palps intact.

In an extensive canopy fogging project in western Sabah, Borneo, which yielded almost 6000 adult spiders, spiny theridiids were well represented. When sorting the samples of this project, these spiders turned up in a variety of species. They aroused my curiosity; in my quest to find generic and when possible specific names to these spiders, identification keys in Simon's Histoire Naturelle des Araignées lead to the genus *Meotipa* Simon. This genus has been synonymized with *Chrysso* by Levi & Levi (1962). I contacted Herb Levi, who replied that since his 1962 paper he had personally observed such spiny theridiids in Papua New Guinea, and was puzzled by them as he rarely had seen such spiders in other parts of the world. He wondered if all these spiders really were monophyletic and the spines a synapomorphic trait. He was so kind as to send me a male and female of *Chrysso albomaculata* O. P.-Cambridge from Central America, the type species of *Chrysso* to which genus these spiny spiders formally belonged.

Descriptions and illustrations of spiders with similar spiny habitus have turned up in some recent works on oriental theridiids in the genus *Chrysso* (Song & al. 1999, Yoshida 2003, Zhu 1998). In order to find out about their relationship with the American type species of *Chrysso* and with other South-

east Asian *Chrysso* species, I went through my entire Southeast Asian spider collection, now in RMNH Leiden, to find possible answers to these questions.

Material and Methods

This paper is based on the theridiid material in my private Southeast Asia collection, now in RMNH, Leiden. This collection encompasses material from Sri Lanka, Thailand, Malay Peninsula, Sumatra, Borneo, Java, Bali, Lombok, Sumbawa, Sumba, Sulawesi, Ambon and the Banda Islands (Moluccas), Luzon (Philippines) and N. Queensland. In total, 262 vials contained spiny *Chrysso*-like theridiids. The type specimen of *Meotipa picturata* Simon from India and *M. vesiculosa* Simon from Luzon were compared and also a male and female of *Chrysso albomaculata* O. P.-Cambridge, 1882 (type species of *Chrysso*). 20 vials containing *Chrysso nigra* (O. P.-Cambridge) from Sri Lanka and Indonesia were also examined. Palps and vulvae were separated and immersed in clove oil for clearance. Drawings were made by using a Zeiss Stemi SV 11 stereo microscope with drawing tube.

Measurements are in mm.

Unless stated otherwise, the material is deposited in RMNH.

In the figures, scale lines have been omitted, all measurements can be found in the text or are indicated in the legend.

Abbreviations:

MNHN	Musée Nationale d'Histoire Naturelle, Paris
RMNH	Rijksmuseum van natuurlijke historie (National Natural History Museum), Leiden
PRD	P. Robert Deeleman
CLD	Christa L. Deeleman
d	diameter

Legend scales (see plate bottom right corner):

Scale A	1 mm
Scale B	0.40 mm
Scale C	0.6 mm
Scale D	0.25 mm
Scale F	0.30 mm
Scale G	0.125 mm
Scale H	0.087 mm

	Chrysso albo-maculata	"*Chrysso*" *nigra*	"*Chrysso*" spec. Ambon	"*Chrysso*" *spini-ventris*	"*Chrysso*" spec. Borneo	*Meotipa*
abdomen tip with flat spines	–	–	+	+–	+	+
abdomen colour uniform	–	+	–	–	–	–
abdomen with black spots	+	–	–	–	–	+
abdomen with stripes	+–	–	+	+	+	–
abdomen with lateral humps	–	–	–	–	–	+
abdomen with rounded knob	–	–	–	–	–	+
conductor + embolus protruding	–	+	+	+	+	+
conductor diverging	–	–	+	+	+	+
epigyne flat	+	–	–	–	–	–
fertilisation duct long, thick	–	–	–	–	–	+–
leg patella + tibia dorsally with flat spines	–	–	+	+	+	+
dwarf male	–	–	–	–	–	+
stuck emboli	–	–	–	–	–	+–
"side lyer"	–	–	+	+	?	+
alleged endemic distribution	–	?	+	–	+	–

Tab. 1. Some key characters in *Chrysso albomaculata*, "*Chrysso*" *nigra*, *Meotipa* and "*Chrysso*" *spini-ventris* with 2 related species from Kalimantan (Borneo) and Ambon.

Results and Discussion

Many Southeast Asian species described in *Chrysso* are more closely related to *Theridion* and *Achaearanea* than they are to the type species, the American *Chrysso albomaculata* (Tab. 1).

The genus *Chrysso* as conceived at present is polyphyletic. A part of the Asian species which at present are listed in this genus is unrelated to *Chrysso albomaculata*. Both species for which the genus *Meotipa* was created: *M. picturata* (type species, India) and M. *vesiculosa* (type locality Luzon, Philippines) proved to be present in the studied material; the latter is present in both sexes and is widespread in the Southeast Asian Archipelago and China and Japan. Males and females of a new species, closely related to *M. picturata* were found in Sumatra, Malaysia and Java and are described here; it is named after Konrad and Barbara Thaler. Four new species were found in sufficient numbers to be described. A few others, represented by single females were left un-described. In all species that unequivocally could be identified as *Meotipa*, the considerably smaller males were much harder to find than the females. They share very few apomorphies with *Chrysso albomaculata* (Tab. 1). *Meotipa* appears to be a "good" genus.

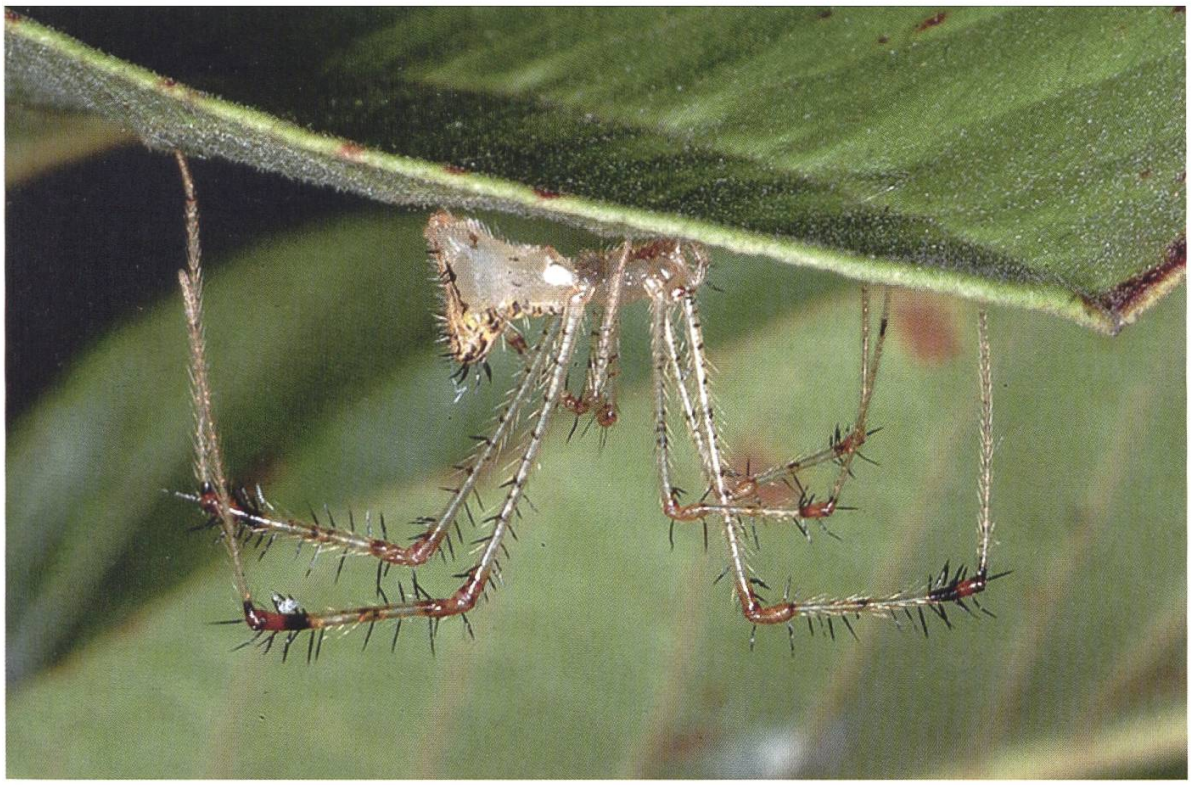


Fig. 1. *Meotipa picturata*, female, Brunei. Foto J. Koh.

Apart from the species described below in *Meotipa,* numerous other, mostly smaller species with black flattened spines are believed to be related to the species mentioned above; they categorically differ, however, in a set of characters, forming a well defined, very species-rich group of spiders. One species, "*Chrysso*" *spiniventris* O. P.-Cambridge is well-known and widely distributed from Sri Lanka to Japan. These species, from now on referred to as *spiniventris* group, and of which the relationship is still to be established, probably form a monophyletic group with *Meotipa*. Two localities, viz. in the primary rainforest of Bohorok in the north and Ketambe in the southwest of the former Gunung Leuser National Park in North Sumatra were found to be richest in *Meotipa* species, viz. three species each. Four species of the *spiniventris* group were found in Ketambe; this part of the former reserve has since then been logged.

Species descriptions

Meotipa Simon, 1895

Type species *Meotipa picturata* Simon, 1895.

Genus diagnosis: Species belonging to the *Theridion* group. Females of *Meotipa* differ from all other theridiids by a combination of the unusual outline of the

abdomen, the tip projected upward and backward over the spinnerets similar to some *Argyrodes*, and with apically a rounded knob bearing conspicuous black flattened spines or scales, often also born on the rear face of the abdomen. One or two pairs of lateral abdominal humps is characteristic. The abdomen is vividly coloured in white and black and often red. Femur and tibia of leg I and leg IV have a darkened tip with a brush-like congregation of enlarged flattened setae (Figs. 13, 21). In females, metatarsi are considerably thinner than tibiae (1/2–1/3 width, Fig. 13). All known species have dwarf males. The male genital organs resemble those in *Theridion* and *Achaearanea*, the conductor projects beyond the cymbium edge, it is spoon-shaped and widening distally (Figs. 10–12, 18, 45).

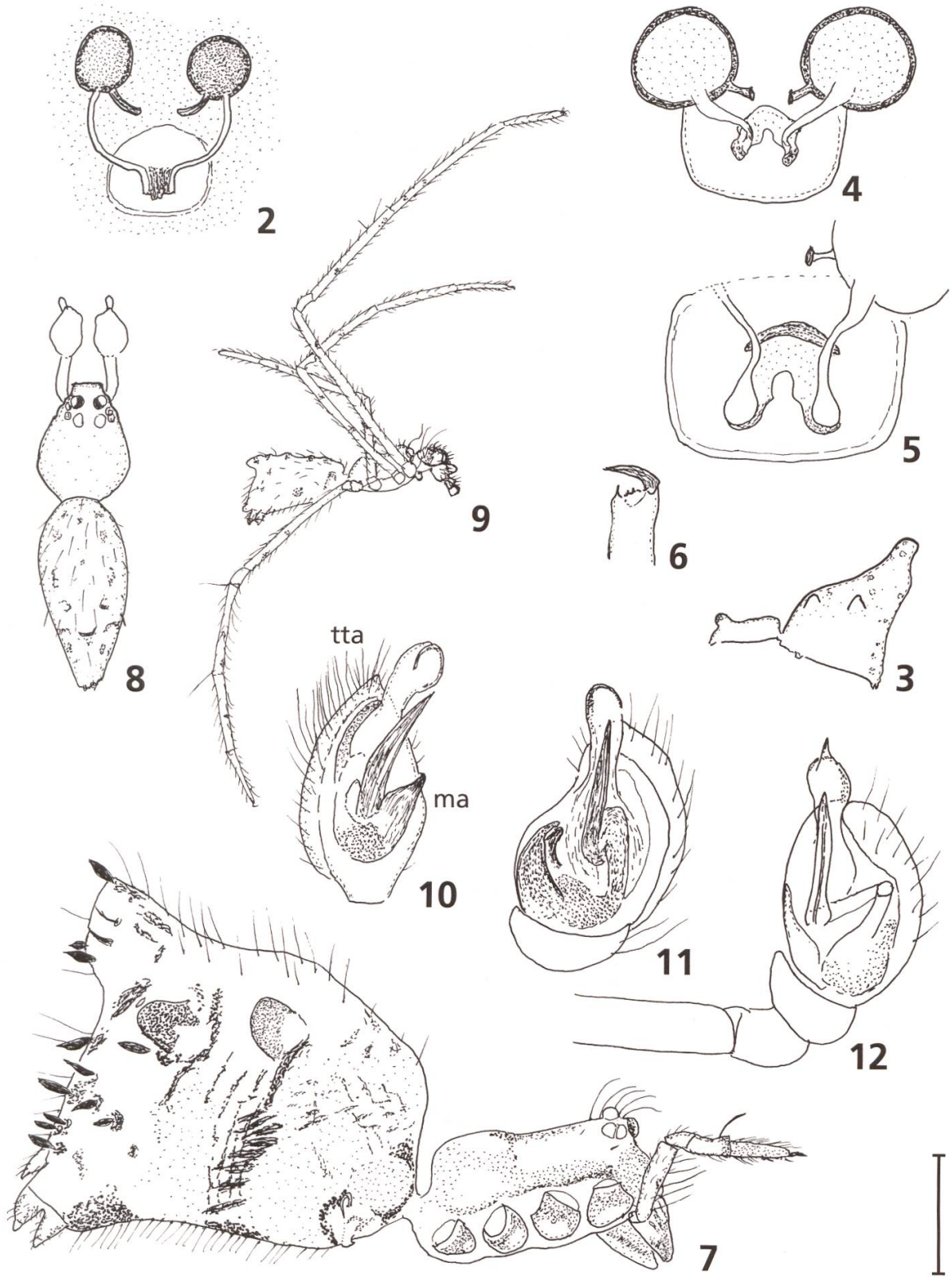
Description: Spiny theridiids with irregularly shaped abdomen, females 2.5–6.0 mm long, males 1.1–1.8 mm. Eyes are relatively large, somewhat variable, uniform in size or middle eyes larger than side eyes, arranged as in other theridiines; they often have a reddish tinge. AM eyes are dark, other eyes mother-of-pearl white. Chelicerae with 1 tooth on apex of median edge, 0–2 denticles on the apical margin (Fig. 6). Leg IV longer than leg II: I>IV>II>III. The cymbium of the male palp is truncated, barely prolonged beyond the alveolus. The embolus is short (Figs. 10–12, 18, 19) to very long (Figs. 33, 34, 37).

The epigyne has a deep pit-like atrium or plate lodging the copulatory pores. The copulatory ducts consist of a wide basal part narrowing abruptly into a tube-like distal part. The spermathecae are round or reniform, the fertilisation ducts are prominent, relatively long, sometimes longer than the spermatheca, as in *M. impatiens* sp. nov. and *M. pallida* sp. nov. Female palpal tarsi bear a long claw with 6–10 teeth. Breaking point on legs: coxa-trochanter. All species of which males are known (4) exhibit a pronounced male dwarfism; sexual cannibalism is probably normal in *M. bituberculata* sp. nov. and *M. impatiens* sp. nov.

Field notes and photographs witness the strange resting behaviour: pivoting the body axis over 90° so that it rests with one side turned towards the leaf-surface, legs wrapped in a semicircle on the leaf surface (see Figs. 1, 21).

Distribution: India, Viet Nam, China, Japan, Thailand, Malaysia, Indonesia.

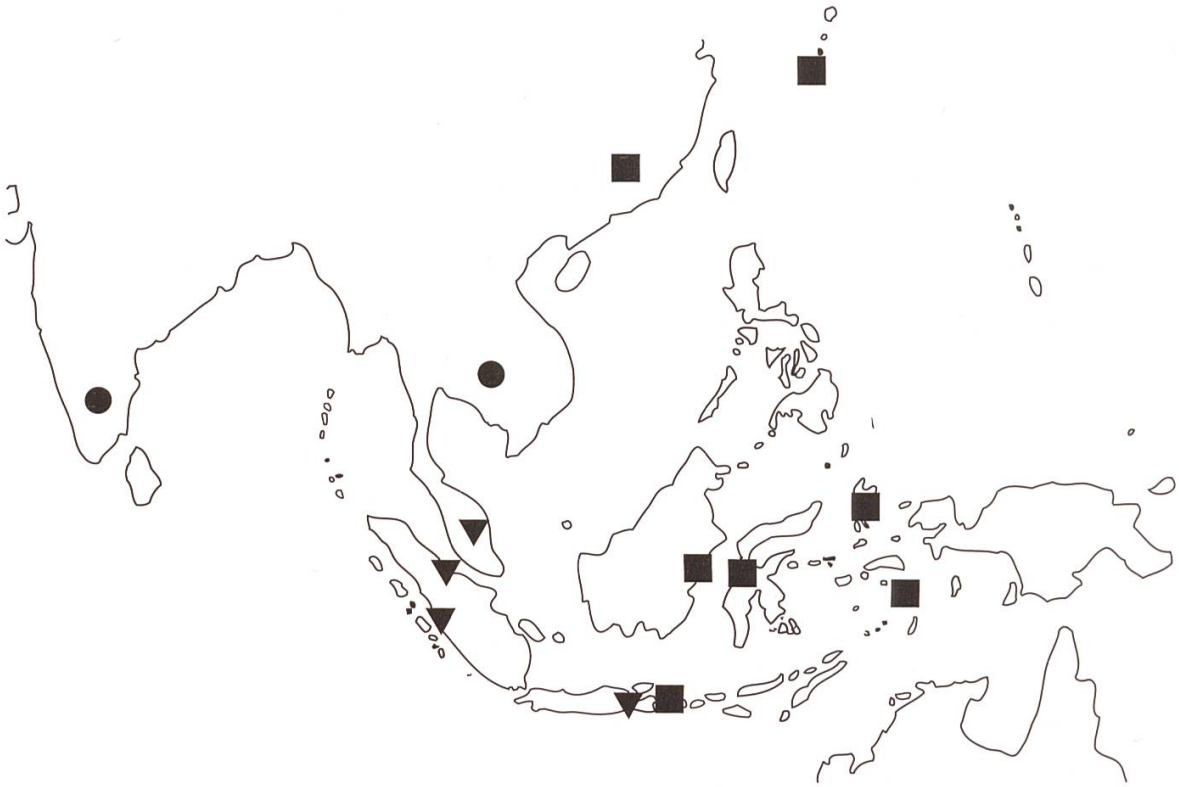
Habitat: Primary rainforest, old secondary undisturbed forests.



Figs. 2–12.
2–3: *Meotipa picturata* Simon, type. – 2: Vulva, dorsal G; – 3: Habitus, side.

4–7: *Meotipa thalerorum* sp. nov., female type. – 4: Epigyne/vulva, ventral, cleared in clove oil G; – 5: Vulva, dorsal, id. H; – 6: Chelicera, ventral D; – 7: habitus A.

8–12: *Meotipa thalerorum* sp. nov., male paratype. – 8: Habitus B; – 9: Habitus with legs A; – 10: Palp, prolateral G; – 11: Palp, ventral, right palp, mirrored; – 12: Palp, retrolateral (ma = median apophysis, tta = theridiid tegular apophysis). 7 same scale as 9; 2 same scale as 4.



Map 1. Distribution of *Meotipa picturata* Simon (●), *Meotipa thalerorum* sp. nov. (▼) and *Meotipa vesiculosa* Simon (■).

***Meotipa picturata* Simon, 1895** (Figs. 1–3, map 1)

Meotipa picturata; Simon (1895): Ann. Soc. ent. France 64: 131–133, ♀, Montes Kodei Kanel, India. Levi & Levi (1962): figs. 112–113, ♀, genital organ.

Type material: ♀ holotype, MNHN AR 2009 Kodei Kanel, examined. New typed label, original label removed.

Other material: Thailand: Ratchasima Province, Khao Yai N. P., 700 m, 1 ♀, 2. iii. 1986 (PRD); Kanchanaburi Province, Erawan waterfalls N. P., deciduous forest, 1 ♀, 11.–14. iii. 1986 (CLD+PRD). Indonesia: East Kalimantan, 1° 12" S, 116° 52' E, sea level, Russian Road km 5.1, 8. xi. 1975, J. R. Thomson; Sulawesi, Tangkoko, 1 ♀, Ken and Rod Preston.

Diagnosis:
Epigyne very small, with deep round pit, in the middle of which emerges an erect straight rod-shaped projection, the length of which equals the pit depth. Abdomen with 2 pairs of small lateral humps, which are obsolete in all specimens from Thailand and Indonesia. Pattern of abdomen characteristic.

Description of the holotype:
Most legs lost, all abdominal spines lost. Total length 4.5, carapace 1.6 long, 1.1 wide. Clypeus 0.65.

Carapace: Coloration faded, no rings visible on legs, no pattern on carapace and abdomen.

Legs: leg I: femur 5.4, patella 0.5 rest lost. Leg II: femur 3.5, patella 0.5, tibia 3.0, metatarsus 2.9, tarsus 0.8; leg III: femur 2.7, patella 0.5, tibia 1.2, metatarsus 1.8, tarsus 0.7; leg IV: (loose) femur 4.2, patella 0.5, tibia 3.0, metatarsus 4.0, tarsus lost.

Palp: femur 0.5, patella 0.14, tibia 0.25, tarsus 0.5 long.

Abdomen: 3.1 long, 3.9 high, 2.3 wide, two pairs of shallow lateral humps.

Epigyne/vulva: 0.2, see Fig. 2 and Levi & Levi (1962; figs. 112–113).

Description of fresh females from Thailand and Indonesia:

Total length 4.5–6.0.

Legs: Distal part of femora and tibiae I and IV with black "cuffs" and numerous spines, including several ventral spines on femora.

Abdomen: shape of dorsal knob variable, both knob and rear surface bearing a variable number of black flattened lanceolate spines. Coloration pattern diagnostic: dorsal knob bearing some round black spots on the dorsal surface. Rear abdomen face white, bordered laterally with one or more black bars. Venter colourless, except for a pair of coal-black transverse bars anterior to the epigyne being bent backwards, then curling around the corners of epigastric furrow. One median and a pair of lateral small black bars in the middle and 2–3 dark elongate spots in front of the spinnerets.

The epigyne conforms with that of the type with the exception of the spermathecae, being separated less than their diameter.

Note: In the original description, no mention is made of black or flattened spines on the abdomen in the only specimen known. They may have been lost; this is sometimes the case also in fresh specimens of other *Meotipa* species. Flattened spines however figure in the original description for the apex of tibia I:(*"pilis nigris magnis et lanceolatis munito"*).

Distribution: India, Thailand, Indonesia.

***Meotipa thalerorum* sp. nov.** (Figs. 4–12, map 1)

Type material: Holotype ♀, Indonesia: Sumatra, Prov. Sumatera Utara (North), Gunung Leuser N. P., Bohorok Rehabilitation Centre, primary dipterocarp rainforest, bamboo near centre, 2. i. 1984 (PRD+CLD).

Paratypes: same data, 1 ♀, riverside, 30. xii. 1983 (PRD+CLD); same data, 1 ♀, trail 6, 7. iii. 1983, S. Djojosudharmo, with 1 ♀ *M. vesiculosa*; 1 subadult ♀, Prov. Aceh, Gunung Leuser N. P. at Ketambe, primary dipterocarp rainforest, before it was destroyed, trail 1.14, tree buttresses, 14. ii. 1985, S. Djojosudharmo.

Other material: Prov. Sumatera Barat (East), Mt. Singgalang (Bukittingi), Anai, 430–460 m, secondary forest, 4 ♀, 10.–20. vi. 1994, S. Djojosudharmo; 1 ♂, 400 m, night collecting, 10.–19. vi. 1994, S. Djojosudharmo. Eastern Java: Pujon Pass west of Malang, 800 m, secondary forest, 1 subadult ♀, 18. vii. 1982 (PRD+CLD). Malasya: Selangor, Templer's Park, 1 ♀, 20. iii. 1985 (PRD).

Diagnosis:
Closely related to *M. picturata*, distinguished from that species by the presence of 2 pairs of prominent lateral humps on the abdomen, the characteristic colour pattern, and details in the epigyne. The flattened spines (scales) on dorsal knob and rear surface of the abdomen are much wider than in *picturata*, leaf- or losenge-shaped, often with needle-like tip, scale l/w ratio 2/1 or 3/1. Legs, especially femora less spiny than in *picturata*. Male very small and pale, conductor characteristic.

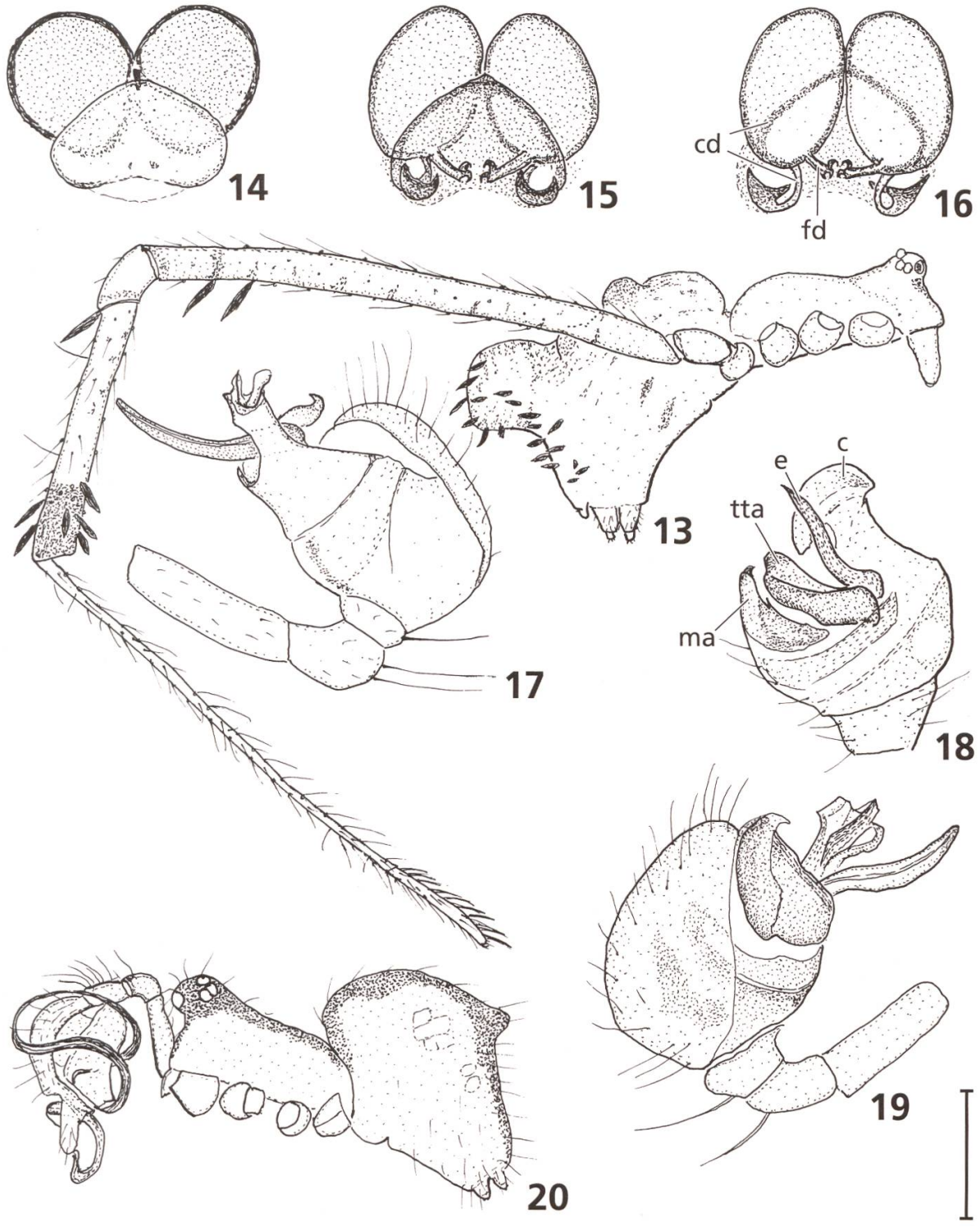
Description:
Holotype ♀: Total length 5.7; (all females 4.5–5,7). Carapace 2.0 long, 1.4 wide. Clypeus 0.5, projecting. Chelicerae with 1 tooth on apex of median edge, 0–1 denticle on apical margin.

Carapace: Buff with reddish median stripe with radiating streaks. Sternum black with triangular white spot in the middle.

Legs: Leg I: femur 6.7, patella 0.7, tibia 4.3, metatarsus 6.7, tarsus 1.4. Leg II: femur 4.3, patella 0.6, tibia 3.4, metatarsus 3.9, tarsus 0.6; leg III: femur 2.7, patella 0.5, tibia 0.7, metatarsus 2.2, tarsus 0.7; leg IV: femur 6.5, patella 0.6, tibia 3.9, metatarsus 5.7, tarsus 1.2.

Palp: femur 0.7, patella 0.25, tibia 0.35, tarsus 0.7.

Leg spines: Less numerous than in *picturata*, width of most leg spines 0.05. Femora I–IV with 1 apical black spine ventrally (often numerous in *picturata*), patellae I–IV 1 apical dorsal, tibiae I–IV 1 dorsal and 4–5 apical spines in a whirl, tibia II 2 apical spines, tibia III 1 dorsal spine, tibia IV a whirl of 3–4 flattened spines apically, patella and tibia each with a black dorso-distal spine. d tibiae 2–3 x d of base of metatarsi, ratio mt I le/d = 100/1.4. Leg I–IV white with transverse black semicircular annulations ventrally on femora; tip of tibia I–IV and base of metatarsi marked black or red and yellow. Tip of all tibiae thickened.



Figs. 13–20.
13–14: *Meotipa vesiculosa* Simon, type, Manila AR 2008. – 13: Habitus A; – 14: Epigyne, ventral F.

15–19: *Meotipa vesiculosa* Simon, Bali. – 15: Epgigyne ventral, cleared in clove oil F; – 16: Vulva, dorsal, cleared in clove oil F; – 17: Palp, retrolatral F; – 18: Palp, ventral, F; – 19: Palp, prolateral F

20: *Meotipa bituberculata* sp. nov., male, Singgalang, habitus C. (c = conductor, cd = copulatory duct, e = embolus, fd = fertilisation duct, ma = median apophysis, tta = theridiid tegular apophysis). Palp same scale as epigynes.

Abdomen: 3.7 long, 3.9 high, 3.1 wide, 2 pairs of dark red prominent lateral humps. Dorso-distal knob with black, very broad scale-like leaf- or lozenge-shaped flattened spines (scales), often sharply pointed, between knob and spinneret area 8–9 such spines on each side of a snowwhite spineless middle zone.

Abdomen with white dorsum, dorsal knob lacks round black spots; flanks pale, pictured with black dots and stripes. Rear face of abdomen white, lacking 1 ♂, black bars laterally. Venter: area in front of spinnerets black, anterior to which two round adjacent white spots, adjacent to 2–3 black longitudinal bars on the anterior side.

Epigyne very small, with central deep pit, in its middle a two-lobed projection enveloping the copulatory pores, lobes diverging. These lobes possibly represent remains of parts of male palps (embolus or conductor).

Description ♂: Paratype: N. Sumatra, same data as holotype.
Total length 1.30. Carapace 0.5 long, 0.25 high, 4.5 wide. Clypeus 0.12, chelicera length 0.25. Chelicera as in female.

Whole spider pale, no pattern visible on carapace and sternum.

Legs: Leg I: femur 1.5, patella 0.12, tibia 1.0, metatarsus 1.12, tarsus 0.5. Leg II: femur 1.2, patella 0.15, tibia 0.6, metatarsus 0.6, tarsus 0.45; leg III: femur 0.7, patella 0.1, tibia 0.4, metatarsus 0.45, tarsus 0.3; leg IV: femur 1.2, patella 0.12, tibia 0.8, metatarsus 0.45, tarsus 0.3.

Leg spines very weak. Leg I–IV with faint semicircular annulations.

Abdomen: 0.85 long, 0.55 high, 0.40 wide. Dorsal knob rounded-conical, lateral humps absent, flattened abdominal spines absent. Abdomen dorsally and ventrally with pattern of faint grey spots as in female; no black in front of spinnerets.

Palp: Femur 0.2, patella 0.07, tibia 0.05, cymbium 0.25 long, 0.15 wide, apical projection 0.03. Palp with large spoon-shaped conductor, distally a membranous disc, distal edge partly aligned with chitinized arch. Embolus simple, straight.

Distribution: Sumatra, Malay Peninsula, W. Java.

Etymology: After Konrad and Barbara Thaler, for their outstanding contribution to Arachnology.

***Meotipa vesiculosa* Simon, 1895** (Figs. 13–19, map 1)

Meotipa vesiculosa; Simon (1895): Ann. Soc. Ent. France 64: 134, ♀, Philippines, Manila.

Chrysso vesiculosa Levi (1962): 232, ♀, figs. 80–81; Yaginuma (1986): 45, ♀, fig. 24.1; Chikuni (1989): 32, ♀, fig. 15; Zhu, (1998): 51, ♀, figs. 25a–c; Song, Zhu & Chen (1999): 107, ♀, figs. 51e–f; Yoshida (2003): 125, ♀, figs. 336, 339–340, 583; Yoshida (2006): 23, ♂, figs. 1–7 (new synonymy of C. *jianglensis*).

Chrysso jianglensis Zhu & Song, in Song, Zhu & Li (1993): 857, ♂, figs. 9A–C; Zhu (1998): 68, ♂, figs. 39A–C; Song, Zhu & Chen (1999): 103, ♂, figs. 9K–L.

Type material: ♀ holotype, MNHN AR 2008, Philippines, Manila, examined. New typed label, original label removed.

Other material: Indonesia: N. E. Bali, Ambengan near Singaraja, secondary forest, near river, 1 ♂ (left palp lost), 2 ♀, 20. i. 1990, S. Djojosudharmo; C. Sulawesi, Lore Lindu N. P., Marena, (Palu), bamboo, 1 ♀, 22.+24. vii. 1982 (PRD+CLD). Moluccan Islands: Banda, Island Lonthoir, abandoned nutmeg estate Selamon, dark shaded valley, 2 ♀, 27. i. 1995 (CLD). E. Kalimantan (Borneo), Tenggarong, light, degraded forest, 1 ♀, 4. viii. 1980 (PRD+CLD). N. Sumatra, Prov. Sumatera Utara, Gunung Leuser N. P., Bohorok Rehabilitation Centre, primary dipterocarp rainforest, riverside, 1 ♀, 30. xii. 1983 (PRD +CLD); same data, trail 6, 1 ♀, 7. iii. 83, S. Djojosudharmo, with 1 ♀ *M. thalerorum* sp. nov. Prov. Sumatera Barat (East), Mt. Singgalang (Bukittingi), Anai, 390 m, secondary forest, night collecting, 1 ♀, 10.–20. vi. 1994, S. Djojosudharmo.

Diagnosis:

Abdomen with 2 pairs of lateral humps, rear face with a double row of flattened spines. epigyne distinctive, wide, with shallow heart-shaped depression. Spermathecae large, roundish, lateral edges aligned with copulatory ducts. Embolus short, strong, flattened.

Redescription of the holotype:

Holotype in good condition, spines and black pattern well preserved, white areas obsolete.

Total length 3.5, carapace 1.1 long, 1.1 wide. Clypeus 0.3, cheliceral length 0.3. Clypeus projecting. Chelicerae with 1 tooth on apex of median edge, 0–1 denticle on apical transverse margin.

Carapace with slight saddle, eyes somewhat raised, clypeus slanting, with dark reddish middle-line, continued on chelicerae. Sternum pustulous towards edge, greyish brown with white middle patch.

Legs: Leg I: femur 3.5, patella 0.55, tibia 2.05, metatarsus 3.35, tarsus 0.8. Leg II: femur 2.15, patella 0.45, tibia 1.25, metatarsus 1.7, tarsus 0.7; leg III: femur 1.45, patella 0.35, tibia 0.75, metatarsus 1.15, tarsus 0.6; leg IV: femur 2.65, patella 0.5, tibia 1.55, metatarsus 2.15, tarsus 0.7.

Palp: Femur 0.4, patella 0.15, tibia 0.17, tarsus 0.3.

Leg spines: Tip of tibia I with 7 flattened spines (only ventral spines present, dorsal spines lost?) tibia IV with 5 spines ventrally, dorsal spines lost. Tibia II and III no such spines distally. All femora with a pair of distal spines ventrally, all patellae with a basal and a distal dorsal flattened spine, tibiae I, III and IV with 1 dorsal spine in the middle, tibia II with one in the middle and one distally. Palpal patella with one flattened dorsal spine. Legs pale, ventrally with semi-circular annulations, narrow distal band on femora and distal band on tibiae yellow or grey.

Abdomen: 1.65 long, 1.35 high, 1.0 wide, with four well developed reddish brown round lateral humps, posterior pair wider apart than anterior pair, base of posterior humps 0.15 across, diameter of flattened spine 0.05. Tip of abdomen with large round knob. Dorsally a central pale band with white and reddish spots, bordered with a zone of dense black dots and lines; flanks with large white and pale zone, venter with four black spots on four corners of a square, in the middle two small black spots; knob with 20 black flattened spines, 0.05 mm wide, l/w ratio 4/1; between knob and spinnerets a bare snowwhite middle zone, on either side a band striped with black, bearing a row of around 8 flattened spines each.

Epigyne/vulva (Figs. 15, 16, from Bali): 0.25 wide. Spermathecae touching. Postero-ventral part a heart-shaped depression, with lateral pockets guiding the embolus towards the copulatory ducts lining the edge of the depression.

Variations:

Female Viet Nam, Tonkin, Camnang (AR 2010, MNHN Paris): 2 ♀, total length 4.2.

Female from Central Sulawesi: Total length 4.6, carapace 1.15, femur I 3.5, abdominal knob longer and more acuminate with 15 spines, rear face with two rows of 9 spines. Female from Sumatra, Singgalang total length 3.0.

Female from E. Kalimantan: Total length 4.4, carapace 1.2, femur I 3.6, abdominal knob 5 spines, rear with 2 rows of 8 spines.

Female I from Bali: Total length 4.8, carapace 1.35, femur I lost, abdominal knob with 14 spines, 4–6 in a row on rear face; female II total length 5.5, cara-

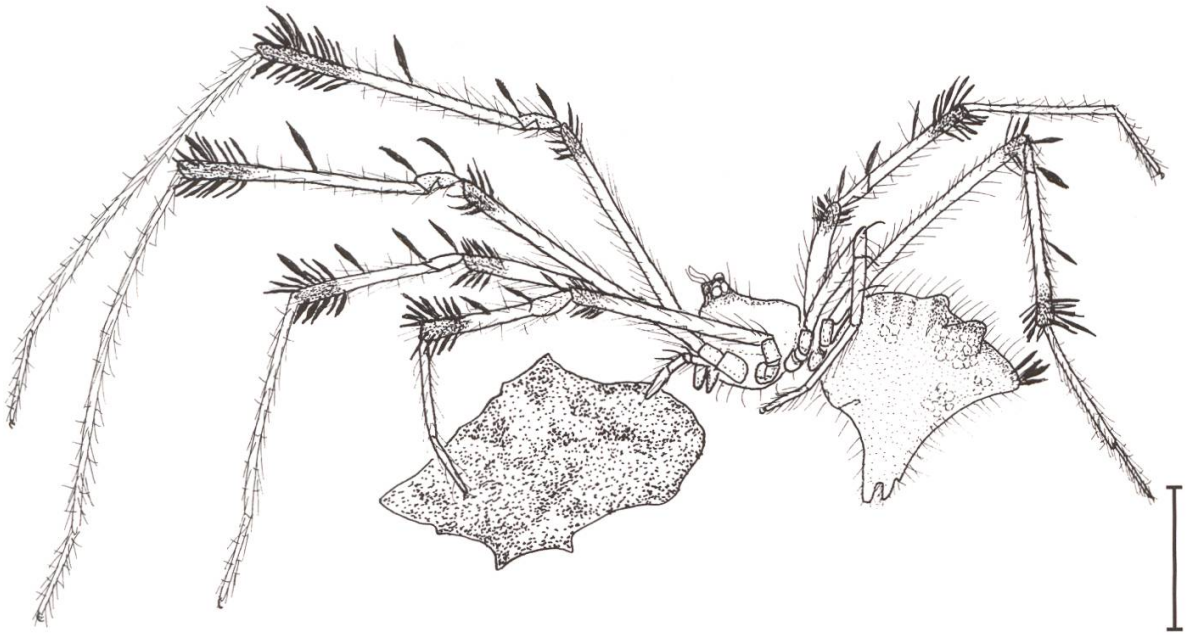


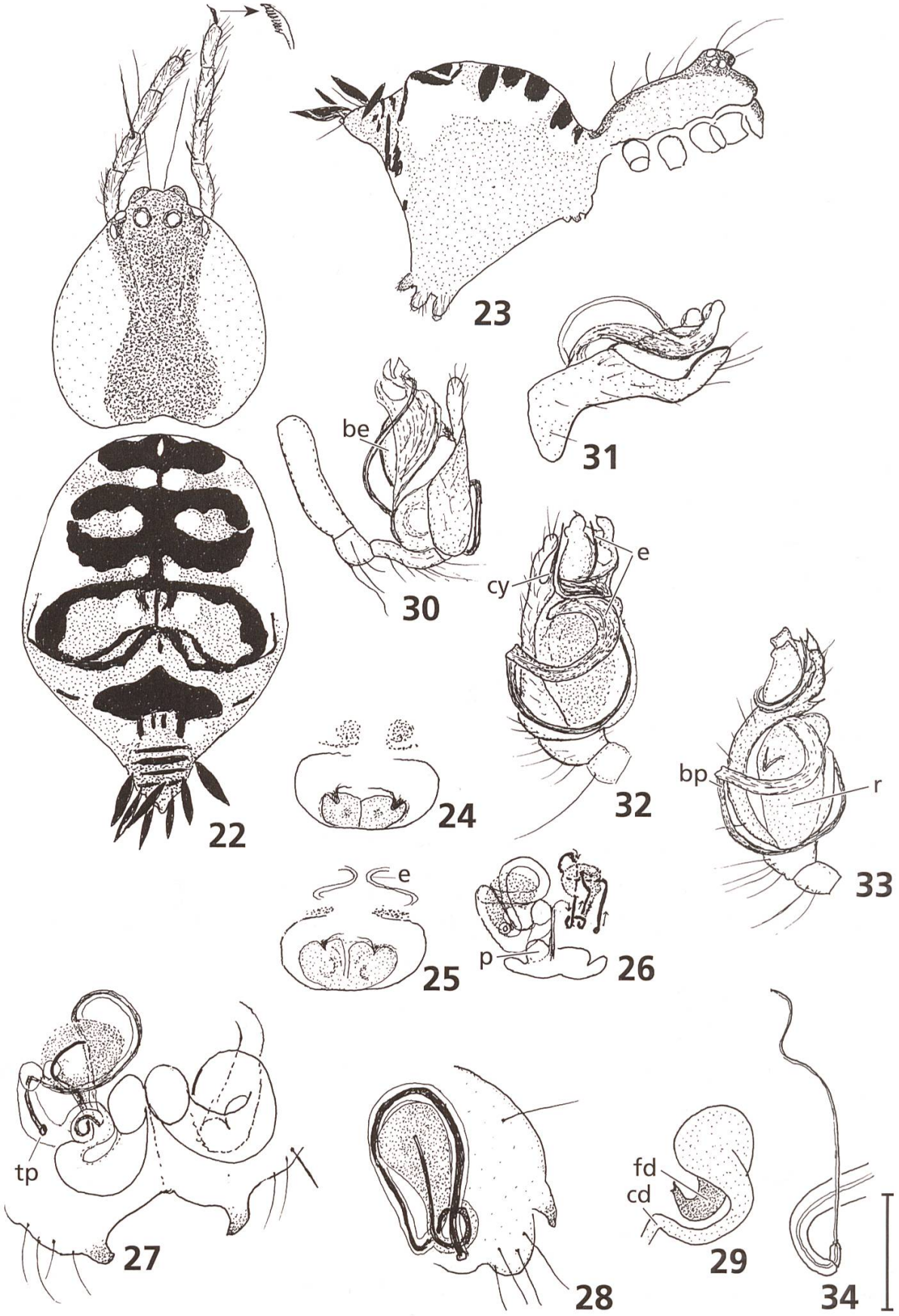
Fig. 21: *Meotipa bituberculata* sp. nov. in resting position, with egg sac.

pace 1.5, femur I 4.3, abdominal knob with 5 spines, rear 2 rows of 3; many spines may be lost.

Females from Banda Islands: Both small specimens, pattern different from that in other localities, one specimen lacking all black also on legs. Female I with black ornamentation: total length 3.0, carapace 1.0, femur I 3.7, knob with 2 spines, none on rear; female II without black: total length 3.3, carapace 1.2, femur I 3.5, knob with 3 spines and 1 on each side of rear. Spination of tibiae I–IV somewhat variable between individuals, no tibia with more than 1 dorsal spine apically. Pattern of sternum and abdomen somewhat variable, all specimens except those from the Moluccan Archipelago with parallel rows of flat spines on rear face of abdomen. Epigyne not basically different from that in other localities.

Description of ♂ from Bali:
Whole spider very pale, no pattern visible on carapace and sternum. Total length 1.6. Carapace 0.75 long, 0.4 high, 0.65 wide; Clypeus 0.2, cheliceral length 0.2.

Legs: Leg I: femur 2.7, patella 0.3, tibia 1.1, metatarsus 1.55, tarsus 0.65. Leg II: femur 1.3, patella 0.25, tibia 0.75, metatarsus 0.95, tarsus 0.62; leg III: femur 0.72, patella 0.22, tibia 0.63, metatarsus 0.67, tarsus 0.37; leg IV: femur 1.3, patella 0.25, tibia 0.87, metatarsus 1.0, tarsus 0.5. Spines on legs weak, a single spine on tibia I. Legs with faint semicircular annulations. Chelicera as in female.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Abdomen: 0.95 long, 1.0 high, 0.65 wide, lateral humps absent. Abdomen white with a pair of faint triangular spots dorsal to the spinnerets; abdominal knob acuminate, 0.3 mm long, three pairs of circular spots on rear face.

Palp: Femur 0.25, patella 0.10, tibia 0.09, cymbium 0.35 long, 0.25 wide, 0.25 high, conductor large and protruding, projected conductor 0.025. Embolus strong, short and flattened.

Distribution: Philippines (Luzon), Indonesia, China, Japan, Viet Nam.

***Meotipa bituberculata* sp. nov.** (Figs. 20–37, map 2)

Type material: Holotype ♀, Indonesia, Sumatera Barat (E. Sumatra), Mt. Singgalang, Anai, 500 m sec. forest, 10.–20. vi. 94; as holotype, 4 ♀; id., 400–430 m, 1 ♂, 13 ♀, 2 juv.; id., 400 m, night collecting, 2 ♀, 1 juv., 10.–20. vi. 94, all S. Djojosudharmo.

Other material: Indonesia: N. Sumatra, Aceh Province, Gunung Leuser N. P., Ketambe, primary dipterocarp rainforest before its destruction, near river, 2 ♂, 12 ♀, 25. v. 1984, Sudiro + Suyono; Ketambe, lowland, trail 12, 1 ♀, 2 subadult ♀, 25. viii. 84; trail 4.2, 3 ♀, 1 subadult ♀, 3. v. 86; id., trail 1.12, 8 ♀, 1 subadult ♀, 24. viii. 84; trail 9+10, 1 ♂, 5 ♀, 6 juv., 2. viii. 84; trail 10, 6 ♀, 21. ii. 85; 1 ♀, 1 juv., 15. ii. 85; trail 8.6, 3 ♀, 1 juv. 4. i. 85; 1 ♀, 3. i. 1985; lowland trail 1.16, 1 ♂, 26. v. 1985; trail 8.1, 1 ♂, 7 ♀, 3. i. 1985, Sudiro+Suyono; Ketambe, 3 ♂, 22 ♀, no date; Ketambe 1400 m, 1 ♀, 28. xi. 84; id., 1 ♀, 17. vii. 85; 2 ♀, 1 juv., 30. xi. 84; all S. Djojosudharmo. Jambi Province, Kerinci Seblat N. P., 800 m, 8 ♀, 20.–30. vii. 1994. West Java Cibodas, Gunung Gedeh N. P., 1500 m, 1 ♀, 6.–8. xii. 86; all S. Djojosudharmo.

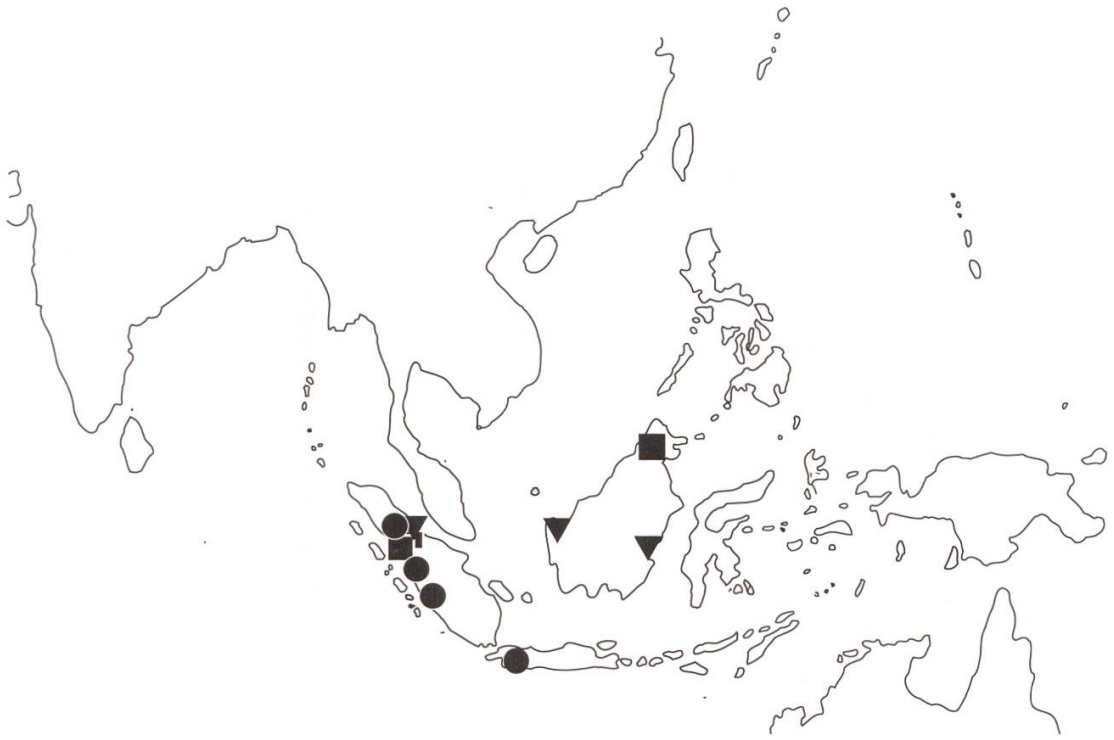
Diagnosis:
Carapace with dark red parallel-sided central band. Adomen relatively short, with one pair of lateral humps only, and dorsal contrasting pattern of black

Figs. 22–34.
22–29: *Meotipa bituberculata* sp. nov., female, Singgalang. – 22: Habitus B; – 23: Habitus side A; – 24: Epigyne, ventral, virgin D; – 25: Epigyne, ventral, with emboli D;– 26: Vulva, dorsal, clove oil, showing course of embolus in right side duct D; – 27: Same, ventral, cleared in clove oil, left side with embolus F; – 28: Same, from side, with embolus F; – 29: Same, without embolus. Same scale as 27 and 28 F.

30–34: *Meotipa bituberculata* sp. nov., male, Singgalang. – 30: Palp, retrolatero-dorsal D; – 31: Palp, disto-dorsal D; – 32: Palp meso-ventral D; – 33: Palp ventral D; – 34: Embolus. Same scale as 24, 25, 26, 28 and 30–33 D. (be = base embolus, bp = breaking point embolus, cy = tip of cymbium with paracymbial incision, e = embolus, fd = fertilisation duct, p = pore, r = sperm reservoir, tp = point of rupture). 24–26 same scale as 30–33. 27, 28, 29 same scale.

Figs. 35–37. *Meotipa bituberculata* sp. nov. – 35: Vulva, dorsal, right side, with broken embolus; – 36: Epigyne/vulva, ventral, right side, with broken embolus; – 37: Male palp, prolateral. Photos: B. Knoflach

and white. Tip of femur I, II and IV with thick black brush. Male palp large and elongate, embolus very long, with loops of embolus around the cymbium; epigynal copulatory duct of corresponding length, fertilisation ducts longer than spermathecae.



Map 2. Distribution of *Meotipa bituberculata* sp. nov. (●),*Meotipa impatiens* sp. nov. (▼) and *Meotipa pallida* sp. nov. (■).

Description:

Holotype ♀: total length 3.25 (smallest 3.0, largest 4.5). Carapace 1.25 long, 1.0 wide. Clypeus 0.25, cheliceral length 0.45. Clypeus projecting. Chelicerae with 1 tooth on apex of median edge, 0–2 denticles on the apical margin.

Carapace with slight saddle, eyes somewhat raised, clypeus slanting. A black band covers the central part of the carapace and widens posteriorly; it is continued on clypeus and front face of chelicerae. Sternum grey. Legs pale, femora and sometimes tibiae with sparse black dots ventrally.

Legs: Leg I: femur 4.2, patella 0.5, tibia 3.3, metetarsus 4.5, tarsus 1.1. Leg II: femur 2.3, patella 0.5, tibia 1.5, metatarsus 2.2, tarsus 0.8; leg III: femur 1.3, patella 0.4, tibia 0.8, metatarsus 1.3, tarsus 0.5; leg IV: femur 2.9, patella 0.5, tibia 1.7, metatarsus 2.4, tarsus 0.7.

Palp: Femur 0.45, patella 0.15, tibia 0.25, tarsus 0.5.

Leg spines: Tip of femur I,II and IV reddish with brush of 15–30 black setae, composed of thin spines and enlarged flattened spines; tip of tibia I, II and IV yellow, red or black; all patellae with a basal and a distal dorsal flattened spine, all tibiae with 1 dorsal spine in the middle, tibia III sometimes spineless. Palpal patella with one flattened dorsal spine.

Abdomen: 1.75 long, 2.0 high, 1.5 wide, with one pair of large round lateral humps. Tip with large round or conical knob bearing 6–7 black flattened spines, all on the dorsal side, l/w ratio 5/1. Area between knob and spinnerets

Fig. 38. ***Meotipa impatiens*** **sp. nov., female guarding egg sac, Sarawak. Photo Th. Platel.**

usually black and spineless. Dorsally a central black band with snowy white patches, bordered with a zone of snowwhite areas; flanks and venter colourless. No two individuals are identical. Lateral humps dorsally black, ventrally white.

Epigyne/vulva (Figs. 24–29, 35, 36): 0.3 wide, a deep cup-shaped pit in posterior half, devided by septum, anterior edge laterally with a tooth. Spermathecae large, round, separated by less than half their diameter. Fertilisation ducts prominent, dark coloured, curving mesally. Copulatory pores in anterior wall of epigynal pit, leading into wide transparent copulatory tubes which curve posteriorly and then anteriorly – near the spermathecae they narrow abruptly and widely loop around the spermathecae towards the entrance of the spermathecae. Fig. 34 shows the embolus on the same scale as the vulva in Fig. 26, indicating the breaking point of the embolus.

Description of ♂: As holotype, Ketambe, 25. v. 1984.
Total length 1.8 (largest male 1.8, smallest 1.5).

Carapace 0.65 long, 0.65 high at eye level, 0.6 wide. Clypeus 0.35, cheliceral length 0.32. Eye region prominent, raised, clypeus long and protruding. A continuous black band stretches from clypeus to carapace through to spinnerets, interrupted only behind the abdomen tip. Chelicerae as in female.

Legs: Leg I: femur 1.6, patella 0.4, tibia 1.6, metatarsus 2.0, tarsus 0.7. Leg II: femur 1.1, patella 0.3, tibia 0.8, metatarsus 0.8, tarsus 0.55; leg III: femur 0.6, patella 0.2, tibia 0.4.5, metatarsus 0.6, tarsus 0.4; leg IV: femur 1.1, patella 0.2, tibia 0.8, metatarsus 1.0, tarsus 0.5. One weak dorsal spine on tibia of each leg and one on each patella. Underside and legs whitish, tip of femora, patellae and tibiae orange.

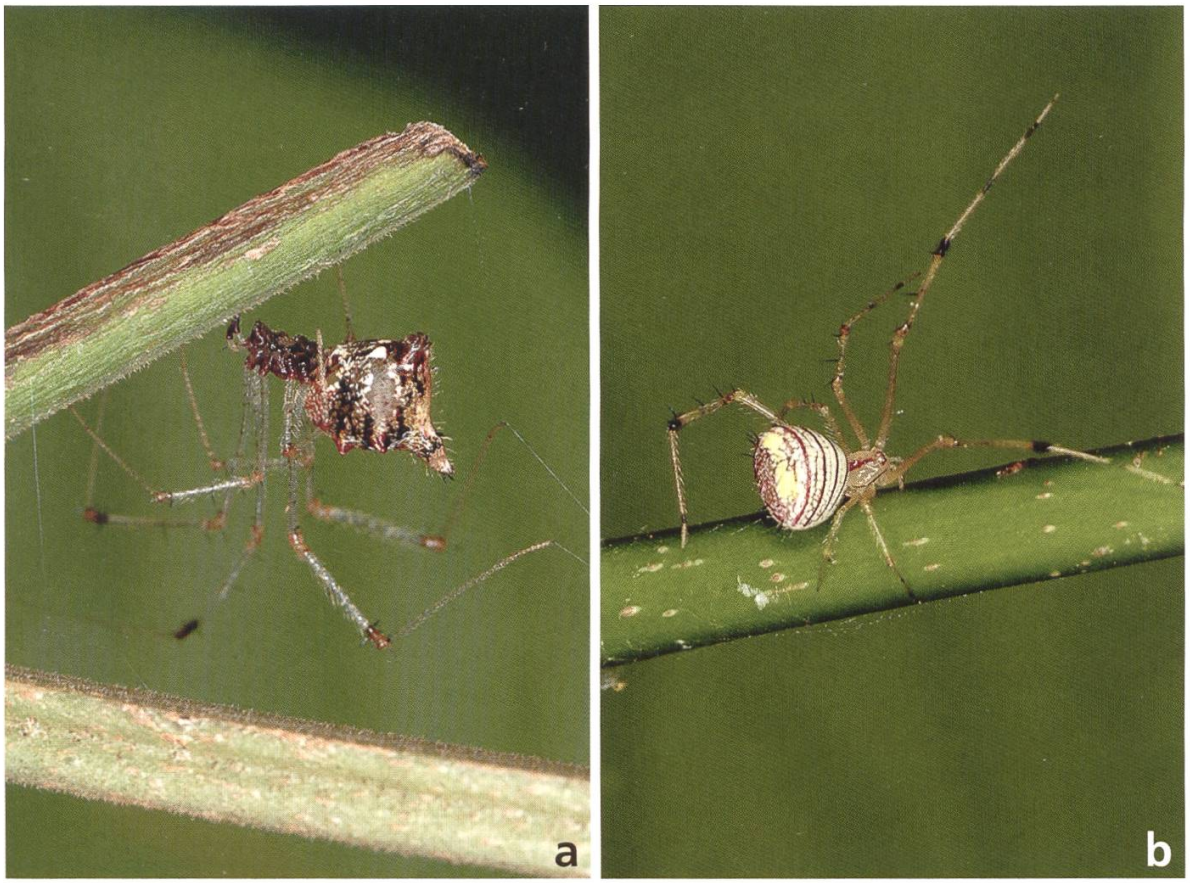


Fig. 39. – **a: *Meotipa impatiens* sp. nov., female; - b: Spiny "*Chrysso*" species. Photos J. Koh, Brunei.**

Abdomen: 1.25 long, 0.8 high, 0.7 wide, lateral humps lacking, dorsal knob more acuminate than in other species, 0.2 wide.

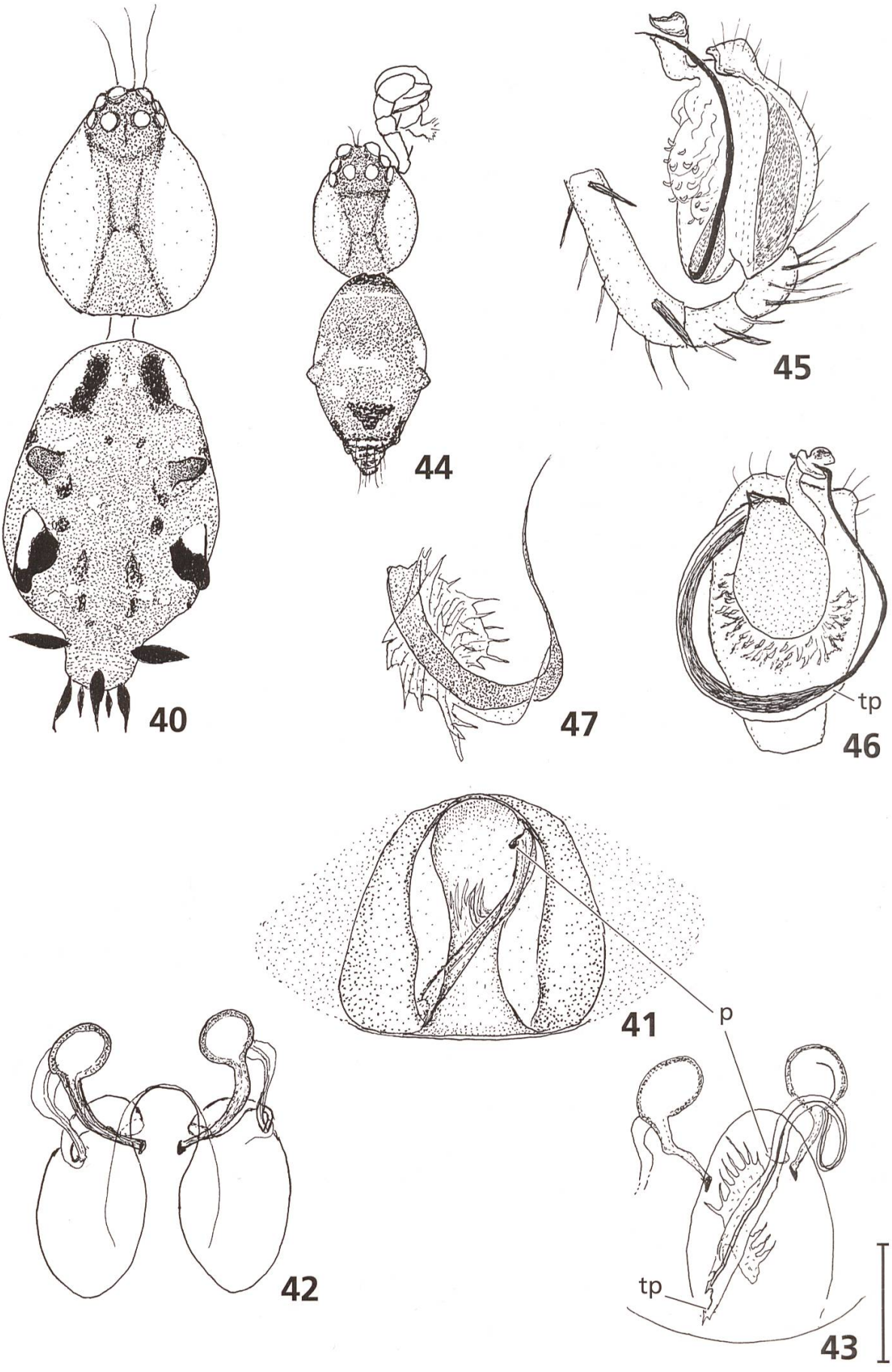
Palp: Femur 0.4, patella 0.15, tibia 0.2, cymbium 0.75 long, 0.3 wide, 0.5 high. Conductor large and protruding. Embolus very long, spiralling in several coils around cymbium. Embolus with thick basal and thin distal part, separated by "breaking point" (Fig. 34).

Variation: No consistent differences were found in the specimens from Sumatra: Mt. Singgalang, Kerinci Seblat N. P. and W. Java.

Distribution: Sumatra, West Java.

Etymology: *bituberculata* = with two humps. One pair of lateral humps on the abdomen in females distinguishes this species from other species.

Remarks on alleged sexual cannibalism: The majority of the females show one, and often two emboli (one on each side) inside the copulatory ducts (Figs. 35, 36). In this species, only the thin, distal part of the embolus remains in the distal section of the copulatory duct of the female after copulation. Emboli of unmated males clearly show a breaking point: correspondingly, in the females there is an abrupt transition from a wide entrance tube into a narrow duct. The sex ratio is biassed towards females: together with 102 adult females, only 9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adult males were collected; none of them had mutilated palps. This suggests cannibalism of males by the females.

***Meotipa impatiens* sp. nov.** (Figs. 38–47, map 2)

Type material: holotype ♀, Indonesia: N. Sumatra, Sumatera Utara Prov., Gunung Leuser N. P., Orang utan rehabilitation Centre at Bohorok, primary dipterocarp rainforest, trail 4, 9. iii. 1983, S. Djojosudharmo.

Paratypes: same data, 2 ♀, 7.–10. viii. 82 (PRD+CLD); riverside, low vegetation, 1 ♂, 2. i. 83 (PRD+CLD); bamboo near centre, 2 ♂, 16. ii. 1983 (PRD+S. Djojosudharmo); trail 6, 2 ♀, 7. iii. 83; trail 4, 1 ♂, 5 ♀, 9. iii. 83; riverside, 6 ♂, 12 ♀, 12. iii. 83; trail 4, 12 ♀, 9. iii. 83; trail 4, 2 ♀, 30. v. 83; bank of river Bohorok, 1 ♀, 1 juv., 31. v. 83; trail 2+4, 1 ♀, 1 juv., 11. vi. 83 (PRD+CLD); trail 3, 2 ♀, 5 juv., 13. ix. 83; trail 3, 1 ♂, 5 ♀, 15. xi. 83; riverside, 9 ♀, 1 juv., 28. ix. 83; trail 4, 9 ♀, 1 juv., 31. xii. 83 (PRD+CLD). All other: leg. S. Djojosudharmo.

Other material: Malay Peninsula: Selangor Province, Templer's Park, K. L., 1 ♀, 23. iii. 85 (PRD+CLD). Malaysian Borneo: W. Sarawak, Semengoh Arboretum, 3 ♀, 6.–10. i. 84 (PRD+CLD); same data, 1 ♀, 1 juv., 24. iii. 85 (PRD+CLD); 3 ♀, 2 juv., 23. iii.–6. iv. 85 (PRD+CLD); W. Sarawak, Matang reserve, 300 m, 1 ♀, 1 juv., 4. iv. 85 (PRD+CLD). E. Kalimantan (Borneo), Sepaku, 40 km north of Balikpapan, stand of primary forest, 1 ♀, 2. viii. 1980 (PRD+CLD).

Diagnosis:
A relatively small species, in both sexes with a distally widening dark longitudinal band on carapace and abdomen. Male palpal cymbium disc-like, embolus in a coil around bulb. Epigyne with huge pit, partly roofed on the sides and often containing one or more stuck emboli. Dorsal pattern of abdomen characteristic.

Description:
Holotype ♀: Total length 3.0, (smallest 2.50, largest 3.50,). Carapace 1.0 long,

Figs. 40–47.
40–43: *Meotipa impatiens* sp. nov., female, type. – 40: Habitus B; – 41: Epigyne with 1 embolus, ventral F. Proximal part of embolus, between tp and p is external, the rest is inside the vulva. Boh A, 12. iii. 83; – 42: Vulva, cleared in clove oil, virgin, dorsal F; – 43: Vulva, cleared in clove oil, with 1 embolus, ventral F.

44–47: *Meotipa impatiens* sp. nov., male. – 44: Habitus, same scale as female (40) B; – 45: Palp, retrolateral F; – 46: Palp, ventral F; – 47: Embolus, separated, showing veil F (p = pore, tp = point of rupture).

0.85 wide; Clypeus 0.3, cheliceral length 0.4. Chelicerae with 1 tooth on apex of median edge, 0–1 denticle on distal transverse margin.

Carapace with slight saddle, eyes somewhat raised, clypeus slanting. Some erect curved spines dorsally on caput and thorax. A broad black median band on the carapace, widening posteriorly, continuing on the clypeus and front surface of the chelicerae. Sternum variable, usually deep red with a white area in the middle, sometimes colourless or entirely reddish.

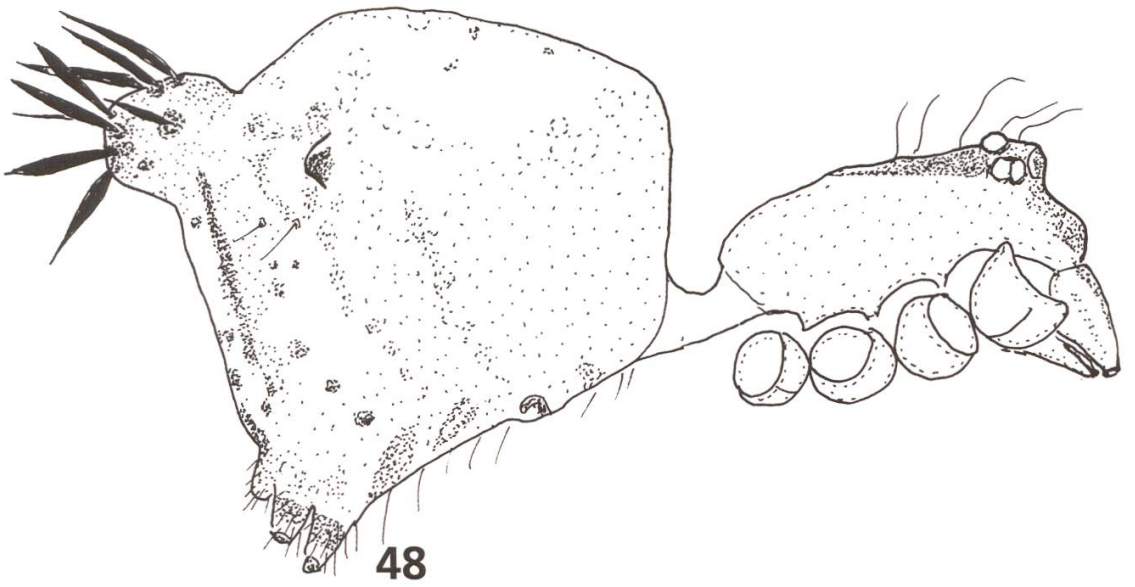
Legs: Leg I: femur 4.2, patella 0.5, tibia 2.8, metatarsus 3.9, tarsus 1.1. Leg II: femur 2.3, patella 0.35, tibia 1.4, metatarsus 1.8, tarsus 0.7; leg III: femur 1.2, patella 0.3, tibia 0.7, metatarsus 1.1, tarsus 0.5; leg IV: femur 2.7, patella 0.5, tibia 1.5, metatarsus 2.1, tarsus 0.7.

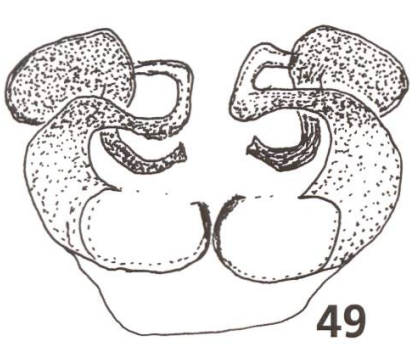
Palp: femur 0.4, patella 0.15, tibia 0.2, tarsus 0.4.

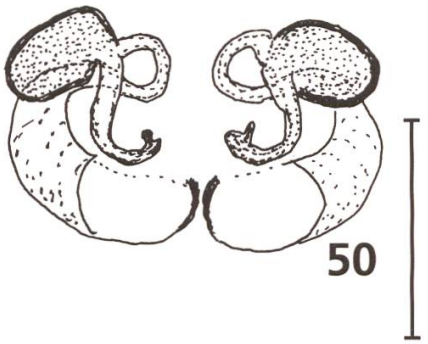
Leg spines: Tip of femora with black brush, tip of tibia I, II and IV yellow, red or blackish with 5–7 black flattened spines and a black brush; patellae with a basal and a distal dorsal flattened spine, patella III often spineless, all tibiae with 1 strong dorsal spine in the middle, sometimes lacking in tibia III. Palpal patella basally with a normal dorsal spine, distally a large black flattened spine, tibia with one thin black spine. Legs pale, femora and sometimes tibiae with sparse black dots ventrally.

Abdomen: 1.7 long, 1.2 high, 1.1 wide, two pairs of humps, base of posterior hump 0.2 across, diameter of flattened spine 0.08. Abdomen with two pairs of large round lateral humps, posterior pair wider apart than anterior pair, dark red, white at the base. Tip with large round or elongate knob bearing 6–8 black flattened spines, l/w ratio 3/1. Dorsally there are two round black areas anteriorly, followed by two white patches, rest of dorsal and rear surface with black, white and red dots, area between knob and spinnerets mottled, spineless. Flanks and venter colourless, dotted with snowwhite, a narrow zone of black extending from between the anterior and posterior hump down to the venter. Venter anteriorly with a snowy white spot in the middle, flanked by a black bar, posteriorly near spinnerets a pair of red bars.

Epigyne/vulva (Figs. 41–43): 0.45 wide. It consists of a large, round, deep excav-ation covered by a vaulted plate which leaves access through a long opening in the shape of a keyhole. The comma-shaped spermathecae are relatively small, separated by more than their diameter, issuing prominent fertilisation ducts. These are longer than the spermatheca itself and dark coloured, situated mesal to the copulatory duct and curving distally inward, ending with a dark rod-shaped tip. Copulatory pores open in the anterior wall of the pit, leading into a wide thin-walled section coiling back and outward, then abruptly narrowing into the distal, narrow thick-walled section of the duct.







Figs. 48–50. *Meotipa pallida* sp. nov., holotype. – 48: Habitus A; – 49: Vulva, cleared in clove oil, ventral; – 50: Vulva, clove oil, dorsal, id.

Description of ♂ from Bohorok, 12. iii. 1983.
Total length 1.4 (largest 1.4, smallest 1.1). Carapace 0.62 long, 0.50 wide. Clypeus 0.18, cheliceral length 0.25. Eye region prominently raised, protruding. A continuous black band stretches from clypeus through carapace, including eye group, to tip of abdomen, and is continued without interruption behind the abdomen tip.

Legs: Leg I: femur 2.0, patella 0.25, tibia 1.5, metatarsus 1.6, tarsus 0.65. Leg II: femur 1.1, patella 0.22, tibia 0.8, metatarsus 0.82, tarsus 0.48; leg III: femur 0.62, patella 0.15, tibia 0.37, metatarsus 0.48, tarsus 0.35; leg IV: femur 1.15, patella 0.17, tibia 0.75, metatarsus 0.82, tarsus 0.4. Legs all white, one strong erect dorsal spine on all leg tibiae and one on each patella.

Abdomen: 0.65 long, 0.65 high, 0.4 wide, 0.25. Abdomen with one pair of small lateral humps on the edge of the black area, dorsal tip black, acuminate or rounded. Central black band on abdomen lined on either side with a row of white dots. Underside pale, epigastric area tinged with black or grey.

Palp: femur 0.4, patella 0.15, tibia 0.13, cymbium 0.4 long, 0.25 wide, 0.28 high. femur with a strong black spine retrodistally and a smaller one near the base, patella with a strong retrolateral spine and a very long erect spine dorsodistally; cymbium round and disc-like in ventral view, protruding part of conductor in a semicircle. Embolus coiled around bulb, surrounded by a large transparent "veil", its edge with numerous pointed slips (Figs. 43, 46, 47). Thick basal part and thin distal part of embolus are separated by an abrupt narrowing, the length of each segment corresponds with those in two corresponding sections of the copulatory duct in the epigyne.

Distribution: Sumatra, Borneo, Malay Peninsula.

Etymology: *Impatiens*, latin for impatient. This name refers to the fact that most females have only one stuck embolus in their epigyne. This unusual state might be interpreted by imagining that the spider devours her mate even before he was allowed to insert his other palp. Alternatively, the male might have been able to beat it after having lost one embolus and preserve the other to inseminate a second female. As all males collected were in the possesion of two intact palps this second explanation seems less probable.

Remarks on alleged sexual cannibalism: The majority of the females in this species show one or two stuck emboli in the vulva. In contrast to *bituberculata* sp. nov., not only the distal thin section of the embolus is left inside the duct, but also part of the wide basal part is present; these are seen as ribbons hanging from the pore and filling a large part of the epigynal cavity. In this species, the basal part of the embolus is surrounded by a veil-like membrane; this membrane was also observed adhering to stuck emboli within the epigynal cavity. The function is unclear. Unlike *bituberculata* sp. nov., the transition between wide and narrow section of the embolus is gradual and lacks a breaking point.

In 56 females collected in Bohorok from iii. 1983 – xii. 1983, the stuck emboli were counted. All stuck emboli had the veil adhering. 25 females had one embolus stuck on the left side of the epigyne, 14 on the right side, 2 females had one embolus in both the left and the right side, one female had 2 emboli on the left side, and 14 females were virgin. In the same period, 11 males were collected in Bohorok, all with intact emboli. In West Sarawak, i.–iv. 1984, 8 females were collected. Here, two females had one embolus on the left, 3 females had one on the right side, one female had an embolus both on the left and the right; 2 females were virgin. No males were collected.

***Meotipa pallida* sp. nov.** (Figs. 48–50, map 2)

Type material: holotype, ♀, Indonesia: N. Sumatra, Aceh Province, Gunung Leuser N. P., Ketambe 1400 m, primary montane forest, 1 ♀ paratype, 1 subadult ♀, 17. vii. 1985, Bugama and Suyono.

Other material: Malaysian Borneo: Sabah, Kinabalu N. P., Poring Hot Springs, primary rainforest at 600 m, canopy fogging *Aporusa lagenocarpa* tree (Euphorbiaceae), 1 ♀, 19. ii. 1996, A. Floren.

Diagnosis:
Large pale species with a broad dark parallel-sided band on the carapace which is not continued on the abdomen. The abodmen is light with a few greyish dots and stripes. The epigyne is characteristic.

Description:
Holotype ♀: total length 5.1 (other female 4.1, Borneo female 4.8,), carapace 1.7 long, 0.5 high, 1.5 wide. Clypeus 0.5. Chelicerae length 0.7, with 1 tooth on apex of median edge, 0–1 denticle on distal margin.

Carapace with slight saddle, eye area level, not raised, clypeus slanting. Some erect curved setae dorsally on caput and thorax. A broad black band covers the central part of the carapace, distinct from that in *M. impatiens* sp. nov. by the lateral edges running parallel; it is continued on the clypeus and first part of the chelicerae. Sternum pale, in the specimen from Borneo with dark spots adjacent to the coxae.

Legs: Leg I: femur 4.75, patella 0.65, tibia 3.45, metatarsus 4.55, tarsus 1.35. Leg II: femur 2.75, patella 0.75, tibia 1.75, metatarsus 2.55, tarsus 0.9; leg III: femur 1.85, patella 0.5, tibia 1.1, metatarsus 1.6, tarsus 0.75; leg IV: femur 3.5, patella 0.85, tibia 2.05, metatarsus 3.05, tarsus 0.9.

Palp: femur 0.55, patella 0.25, tibia 0.3, tarsus 0.65.

Leg spines: Femora ventrally with a pair of weak subapical spines. All patellae dorsally with a basal and distal black flattened spine, tibia I, II and IV with one distal and one in the middle, in tibia III the apical one is lacking. Legs pale, femora and sometimes tibiae with sparse black dots ventrally. Legs not so thin as in the other species: femur I length/diameter in the middle = 100/6 or 100/7 (100/4 in other species). Tip of all femora, patellae, tibiae and metatarsi and base of tibiae and metatarsi with a darkened ring of yellow, red or black, metatarsus I with an additional ring in the middle, femora and some tibiae with dark spots and mottles and femora ventrally with semicircular annulations; apical brushes weak or absent. Palpal patella basally with a normal dor-

sal spine, distally a large black flattened spine, tibia with one thin black spine; tarsus distally with a weak retroventral spine.

Abdomen: 3.5 long, 3.5 high, 2.2 wide, with one pair of lateral humps marked with black, apically the rounded knob bearing 8–10 black flattened spines with acuminate tip as in *picturata* but not so thin; width of flattened spine 0.07, l/w ratio 6/1. Abdomen predominantly pale, markings few compared to the other species, with dark grey round spots on the knob and 2–4 rows of small dark spots on the rear surface and on the flanks; in the specimen from Borneo also one uninterrupted line. There are no red spots. Venter with a pair of dark bars in front of the spinnerets and two faint skewed bars and a middle line. Dorsally and on the rear surface some white areas.

Epigyne/vulva (Figs. 49, 50): 0.35 wide. The posterior depression is bordered with thin black lines joining in the middle and slightly curving up; they constitute the edge of the copulatory pores. The copulatory ducts are thin-walled and are directed outward, then arching inward ventrally across the spermathecae, then narrowing and curving around in a U-turn to join the median side of the spermathecae. The spermathecae are relatively small, reniform, the prominent fertilisation ducts are long, curving posteriorly and mesally, slightly widening at the tip.

Male unknown.

Distribution: Sumatra and Borneo.

Etymology: *pallida* = pale. In relation to the other species described, this species is the lightest in colour.

Systematics

I propose to remove *Meotipa* from synonymy with *Chrysso* and revalidate the genus *Meotipa* on the basis of a number of characters as in the genus diagnosis and Tab. 1. *Meotipa* now includes 6 species; additionally there are three single females, each representing a probably undescribed species.

The "*Chrysso*" *spiniventris* group: A part of the southeast Asian theridiid species with black spines on the abdomen and/or legs seems to be distinct from *Meotipa*. These spiders, related to *Chrysso spiniventris*, are usually small (2–3½ mm)and only distantly related to the type species of the genus: *Chrysso albomaculata* O. P.-Cambridge, 1882 from the New World. Females of members of this group share with *Meotipa* some characters, viz. the black dorsal spines on leg patellae, tibiae and abdomen (which are often lost), the epigynal pores situated in a paired or unpaired pit, the configuration of the male palpal conductor and the resting posture of adult females ("sidelyer" in

Tab. 1, Fig. 38), For several females in this group there are similar field notes as for *Meotipa* on the peculiar resting behaviour, as if lying on one side on the leaf surface. Species related to "*Chrysso*" *spiniventris* differ from *Meotipa* by the posterodorsal angle of the abdomen being conical, evenly rounded or acuminate, but lacking a distinct knob and lateral humps; there are often parallel black or grey stripes or lines, sometimes red, on the dorsum and flanks. In some populations, no abdominal spines are present at all. The clypeus is more vertical. The metatarsi of leg I–IV are only slightly thinner than tibiae in both sexes, the femora and tibiae lack distal brushes with black flattened spines. None of the species has dwarf males.

In our collection, there are around 30–35 distinct such "*Chrysso*" species from various locations, from Thailand through Indonesia into N. Queensland, the majority probably new. The following species, reported from China, Japan and the Philippines, unequivocally belong to this group too: *Chrysso argyrodiformis* (Yaginuma, 1952), *C. lingchuanensis* Zhu & Zhang, 1992, *C. jianglensis* Zhu & Song, 1993, *C. caudigera* Yoshida, 1993, *C. anei* Barrion & Litsinger, 1995 (= *spiniventris*), *C. tiboli* Barrion & Litsinger, 1995 from Mindanao, *C. isumbo* Barrion & Litsinger, 1995 from Palawan and possibly *C. vitra* Zhu, 1998. *C. spiniventris* figures abundantly in our collection, mostly in secondary degraded forests from Sri Lanka to Papua New Guinea. It is known in China and Japan. These spiders have a habitus similar to *Chrysso cambridgei* (Petrunkevitch, 1911) (Knoflach & Pfaller 2004, p. 116, fig. 3f and Knoflach 2004, p. 187, figs. 28a–c). The cosmotropic species *Chrysso pulcherrima* (Mello-Leitão, 1917) has been introduced from Asia into the western hemisphere (Levi 1962: p. 232). At present, the taxonomical position of this species group is in the genus *Chrysso*. They probably are unrelated to other Southeast Asian species placed in *Chrysso*, such as "*Chrysso*" *nigra* (O. P.-Cambridge, 1880). Describing the new species, either in *Meotipa* or in a new genus, is not the scope of this paper.

Remarks on canopy species and distribution

Since new, efficient collecting techniques have been made available, incredible masses of canopy material are waiting in alcohol to be described. Unfortunately, taxonomists to tackle them are scarce. In Southeast Asia the specific canopy fauna, (except the widespread, versatile generalists that easily migrate and are found in a variety of habitats) is still poorly known due to a lack of availability of comparable canopy material from areas other than North Borneo. In the Sabah (North Borneo) canopy project (Floren & Deeleman-

Reinhold 2005), 311 species could be distinguished from the primary rainforest at Poring (34 samples). Of these, 80 could be recognised as named species (24 described species described by CLD-R based on Poring material an additionally 6 species based on other type localities). An impressive number of 95 morphospecies (and additionally 53 singletons) was absent in samples from disturbed forest and were, more significantly, also absent in the 40 years old secondary forests adjacent to the primary forest. In these samples figured eight species of the spiniventris group, mostly from older forest (primary and secondary 40 years). Of these, only two species were found also in the understorey. A similar situation was found in many other spider groups, corroborating the concept of the existence of a certain obligate canopy fauna which rarely descends to the undergrowth realm where naturalists normally have observed and collected. This category of canopy organisms contains a high proportion of undescribed species. Contrary to Southeast Asia, canopy fogging experiments in European primary forest showed neither a separation of primary/secondary, nor of canopy/undergrowth in the spider fauna (Floren, Otto & Linsenmair 2009).

Species multiplication, endemism and biodiversity dimension in the rainforest

In my 10 years experience in comparing the canopy spiders from North Borneo with ground level species in general, in a large number of families I found evidence that endemism in the tropical Asian rainforest plays a crucial role in assessing biodiversity dimensions.

The occurrence of numerous small-range allopatric species is a common phenomenon in the forest spiders in Southeast Asia. This phenomenon has been well documented for humus- and ground-dwelling spiders (Tetrablemmidae: Lehtinen 1981, Deeleman-Reinhold 1980, Oonopidae, Ochyroceratidae: Deeleman-Reinhold 1987, 1995, Corinnidae: Deeleman-Reinhold 2001), but also applies to spiders living in the undergrowth, low vegetation, and canopy (Linyphiidae: Millidge & Russell-Smith 1992; Clubionidae, Systariinae, Corinnidae: Deeleman-Reinhold 2001; Pholcidae: Huber 2005). In the long-term canopy project in Sabah, 30 species of the family Clubionidae were found. The clubionid spiders of a similar project in Papua New Guinea, separated by approximately 3500 km in east-west direction from Sabah, carried out in undisturbed rainforest canopy were studied and identified by CLD-R; 40 species could be distinguished. Of these, only one species (*Pteroneta saltans* Deeleman-Reinhold, 2001) was shared!

Oriental tropic rainforests are characterised, like all forests near the equator, by long stretches of uninterrupted continuous rainforest and high humidity. There lives a high diversity of plant and animal species under stable conditions: with redundant basic provisions and energy it constitutes an ideal environment. A humid rainforest does not burn: no fragmentation or isolation towards forest patches occurred naturally. Here, the number of niches is immense and probably constantly changing, and genetic variation and speciation is believed to be faster and more frequent than in the rest of the world; every whim of evolution becomes a potentially viable organism. Many of them met no competition in the copious luxuriousness and could survive in their little restricted niche, living side by side and interacting with mobile (volatile) widespread relatives. All this could have important consequences for the assessment of spider species richness. Under these circumstances there was little incentive for tree spiders to develop skills for moving such as ballooning. The number of small-range species must have been enormous, and may once have outnumbered many times the more widely distributed species. What has been the impact of forest destruction and fragmentation, the degradation of the rainforest into archipelagoes of desiccating forest patches of highly variable quality on the biodiversity ? The "whims" have disappeared, many of the small range – species found their ranges chopped up into miniature segments. This may have lead to either more speciation in some taxa and to extinction in others. Small organisms may be able to survive in the small forest patches. Unfortunately the great majority of the species from under-collected regions and habitats have not been described and named and we have no possibility to count the species and establish changes in size of species ranges, nor to predict the size of the total species load and the value of remaining forests to be protected. Only when a great quantity of material has been characterized and visualized, described and named in a way that is easily accessible for workers worldwide, distribution ranges can be established and consequently, present state of species richness and diversity can be assessed.

Note added in proof

Chrysso spiniventris, *C. argyrodiformis* and *C. pulcherrimus* recently were placed in *Meotipa*: Yoshida, H. (2009): Theridiidae. — In: Ono, H. (ed.), The spiders of Japan, p. 356–393, Tokai University Press, Minamiyana.

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